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(पहला पुनरीक्षण)

Guide for Storage of Pears

(First Revision)

ICS 67.080.10

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June 2022 **Price Group 3**

Fruits, Vegetables and Allied Products Sectional Committee, FAD 10

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fruits, Vegetables and Allied Products Sectional Committee had been approved by the Food and Agriculture Division Council.

To ensure fuller utilization of perishable foodstuffs such as fruits and vegetables it is necessary that they should be preserved under conditions so as to maintain their fitness for fresh consumption over a period of time. Refrigeration is one of the important means to preserve these food-stuffs. For cold storage of various fruits and vegetables based on scientific lines, a series of Indian Standard guides have been issued. It is hoped that these guides stipulating the conditions to be maintained for different fruits and vegetables would prove to be helpful in better administration of cold storages and in preventing avoidable wastage of fruits.

This standard was first published in 1975, for which assistance had been drawn from the then ISO Draft International Standard on the subject. The first revision of this standard is being brought out to align the conditions of storage with those prevailing in Indian scenario.

This standard provides guidance on storage of pears, however, because of the variability of the product according to the time and place of cultivation, local conditions may make it necessary to define other conditions for harvesting or other physical conditions in the store.

The application of the guidelines contained in this Indian Standard should enable much wastage in storage to be avoided and thus should enable long-term storage to be achieved in most cases.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GUIDE FOR STORAGE OF PEARS

(First Revision)

1 SCOPE

1.1 This standard describes methods for obtaining conditions for the successful storage of pears (*Pyrus spp.*).

1.2 Cultivars

The guidelines apply to pears of different cultivars namely, Bartlett, Red Bartlett, Conference, Punjab Nectar, Punjab Gold, Patharnakh and Anjou.

2 TERMINOLOGY

2.1 Gray — Gray (Gy) is the unit of absorbed radiation dose. 1 Gy is equal to 1 Joule of energy/kg of material being irradiated.

2.2 D min — It is the minimum absorbed dose received by the food samples when subjected to radiation treatment.

3 CONDITIONS OF HARVESTING AND PUTTING INTO STORE

3.1 Harvesting

3.1.1 The practical criteria of maturity, most frequently used for defining the best time for harvesting may be as given below:

a) The basic colour of the outer skin*;
b) The age of fruits, expressed as the number of days that have elapsed since full flowing;
c) The hardness of the flesh, when estimated by means of a spring penetrometer should not be less than 7.7-10 kg/cm^2 (Bartlett pear);
d) The ease of picking;
e) Total soluble solids determined by refractometer i.e. 12-13^{o} Brix (Bartlett pear); and
f) DFFB (days from full bloom to harvest): 110-135 days for Bartlett and 110-150 days for Asian cultivars.

*NOTE — The basic ground colour should be distinguished from the red anthocyanin pigmentation, the intensity and extent of which vary according to the variety and, to some extent, with the exposure to sunlight.

3.1.2 These criteria may not be universally valid for a given variety but may vary from one region to another. The grower may decide on his own criteria from those mentioned above for picking, on the basis of experience.

3.1.3 Exact timing of the date of harvesting should be more important for early varieties than for late varieties.

3.1.4 Fixing of time of harvesting should have greater importance for controlled-atmosphere storage than for storage in air.

3.2 Quality Characteristics for Storage

Fruit put into cold storage should be sound, free from bruises or physiological disorders and free from any visible sign of fungal or bacterial attack. It should be clean and dry.

3.3 Treatments with Gamma Irradiation before Storage

Gamma radiation treatment (D min 0.4 kGy) of matured green pears is recommended as a phytosanitary measure to overcome technical barrier to trade. Irradiation of matured green pears at the dose of 1.5 kGy could also delay the ripening and inhibit the decaying of pears up to 2 weeks of ambient storage (25 ± 2°C, RH 70 percent). Irradiation in combination with refrigeration (3 ± 1°C) prevents the decaying of pears up to 45 days as against approx. 35 percent decay in non-irradiated samples. These radiation doses are within the window of approved dose range for fresh fruits and vegetables (Class 2) as per the Rules and Regulations framed under *Food Safety and Standards Act, 2006*.

3.4 Putting into Storage

The fruit should be put into the cold store as soon as possible after harvesting preferably after precooling. The temperature of the fruit should be lowered to a value suitable for the variety within four days. For achieving this, large quantities of cold air should be circulated in the cold storage room.

3.5 Method of Storage

The fruit should be handled with care. The packages should allow free circulation of air. Storage densities of about 200 kg per cubic meter of usable space are recommended.

3.5.1 When the fruits are stored in pellets, the storage density may be increased by 10 to 20 percent.

3.5.2 *Controlled Atmosphere Storage*

Controlled Atmosphere Storage extends the shelf life but internal disorders are the limiting factors. Recommendations for a few varieties are given in Table 1.

4 OPTIMAL CONDITIONS OF STORAGE

4.1 Temperature

4.1.1 Pears should be kept at as low a temperature as possible, subject only to avoiding the risk of freezing. In general, the best results are obtained at – 1°C to + 0.5°C.

4.1.2 A difference of 1°C in storage temperature has a profound effect on the time for which the pears can be kept. It has been shown that during cold storage the freezing point of the fruit falls slightly.

4.1.3 The course of development of the fruit during storage depends on the choice of storage temperature. When the temperature of the cold store is low (– 1°C, + 1°C) the pears change very little during their storage period in the cold store and it is necessary to submit them to a complementary ripening process at a higher temperature when they leave the cold store.

4.1.4 Some varieties ripen completely at higher temperatures only if the preliminary period at low temperature has not been too long.

4.1.5 An accidental rise in storage temperature can initiate ripening, hence while putting fresh fruits lots in cold store, loading arrangement should be such that it does not elevate the temperature more than 2°C.

4.1.6 Certain varieties do not withstand cold conditions well, and storing them at low temperature is sometimes responsible for the appearance of more or less widespread internal browning.

4.1.7 The recommended temperatures for a few varieties are given in Table 1.

4.2 Relative Humidity

Pears may generally be stored at a relative humidity between 90 to 95 percent. If the atmosphere is drier, the fruit develops a stronger taste and aroma, but losses in mass are greater.

4.3 Air Circulation

Periodical changes of the atmosphere is advisable for varieties sensitive to scald.

4.4 Storage Life

4.4.1 The expected storage life for a few varieties is given in Table 1.

4.4.2 Storage should not be prolonged beyond limits compatible with the maintenance of good quality.

4.4.3 Samples of fruit should be drawn regularly in such a way as to detect the appearance of any wastage.

4.5 Operations at the End of Storage

The varieties which should undergo a complementary ripening after cold storage are indicated in Table 1.

Table 1 Recommended Temperatures and Gas Composition

(*Clauses* 3.5.2, 4.1.7, 4.4.1 *and* 4.5)

Sl No.	**Cultivar/Variety**	**Temperature**	**Gaseous Composition**	**Expected Storage Life**	**General Remarks**
(1)	(2)	(3)	(4)	(5)	(6)
1. Cold Storage					
i)	Bartlett	– 1°C to 0°C	–	9 to 11 weeks	a) Complimentary ripening necessary b) Susceptible to scald c) Ripens between 10°C and 24°C only d) Takes 3-6 days at 80-85 percent RH to ripen
ii)	Red bartlett	– 1°C to 0°C		9 to 11 weeks	–
iii)	Conference	– 1°C to 0°C		6 to 7 weeks	–
iv)	Punjab nectar	0°C to 1°C		2 months	–
v)	Punjab gold	0°C to 1°C		2 months	–
vi)	Patharnakh	0°C to 1°C		2 months	1) Patharnakh fruits should be chilled for 3 days at 0°C and ripened at 20°C for 4 days. 2) For proper ripening and improving quality of pear, fruits should be exposed to 100 ppm ethylene gas for 24 hrs and stored at 20°C. The Patharnakh fruits would ripe in 8 days.
2. CA Storage					
i)	Anjou	– 0.5°C to 0°C	1.5 percent O_2 0.3 percent CO_2	9 Months	Storage risks: Skin yellowing, inability to ripen, storage scald, internal browning, skin marking etc.
ii)	Bartlett	– 1°C to 0°C	2-3 percent O_2 4.5 percent CO_2	4-5 Months	–
iii)	Conference	– 1°C	2.5 percent O_2 0.7 percent CO_2	7.5 Months	Storage risks: Internal browning

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Fruits, Vegetables, and Allied Products Sectional Committee, FAD 10

Organization	*Representative(s)*
ICAR-Indian Institute of Horticultural Research, Bengaluru	Dr M. R. Dinesh (***Chairman***)
All India Food Processors Association, New Delhi	Dr R. K. Bansal Shrimati Mamta Arora (*Alternate*)
Association of Food Scientists and Technologists India, Mumbai	Dr Revathy Baskaran Dr K. V. Harish Prashanth (*Alternate*)
CSIR-Central Food Technological Research Institute, Mysore	Dr P. Vijayanand Dr A. S. Chauhan (*Alternate*)
College of Agricultural Engineering Post-Harvest Technology, Gangtok	Dr Sujata Jena Dr Said Prashant Pandharinath (*Alternate*)
Confederation of Indian Food Trade and Industry, New Delhi	Shrimati Priyanka Sharma (*Alternate*)
Consumer Guidance Society of India, Mumbai	Dr Sitaram Dixit Dr M. S. Kamath (*Alternate*)
Dabur Research and Development Centre, Ghaziabad	Shri Dinesh C. Pandey Shri Sumit Nara (*Alternate*)
Defence Food Research Laboratory, Mysore	Dr O. P. Chouhan Dr A. Jagannath (*Alternate*)
Export Inspection Council of India, New Delhi	Shri Parmod Siwach (*Alternate*)
ICAR-Central Institute of Agricultural Engineering, Bhopal	Dr C. R. Mehta Dr M. K. Tripathi (*Alternate*)
ICAR-Central Institute for Subtropical Horticulture, Lucknow	Dr Neelima Garg
ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana	Dr Ramesh Kumar Dr Sunil Kumar (*Alternate*)
ICAR-Central Plantation Crops Research Institute, Kasaragod	Dr Anitha Karun Dr M. R. Manikantan (*Alternate*)
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Indian Institute of Packaging, Mumbai	Dr Tanweer Alam
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National Institute of Food Technology Entrepreneurship and Management, Sonipat	Dr Sunil Pareek

Organization	*Representative(s)*
In Personal Capacity (*CD 223, Ansal Golf Link I, Greater Noida*)	Shri Pitam Chandra
BIS Directorate General	Shrimati Suneeti Toteja ,Scientist 'E' and Head (FAD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shrimati Varsha Gupta
Scientist 'D' (FAD), BIS

Panel for Review of Indian Standards Related to Storage, Transport and Ripening of Fresh Fruits and Vegetables, FAD 10 : Panel 2

Organization	*Representative(s)*
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Bhabha Atomic Research Centre, Mumbai	Dr Satyendra Gautam
ICAR-Central Institute for Subtropical Horticulture, Lucknow	Dr Bharati Killadi
ICAR-Indian Institute of Horticulture Research, Bengaluru	Dr D. V. Sudhakar Rao
Warehousing Development and Regulatory Authority, New Delhi	Shri Vinay Kumar Chauhan

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